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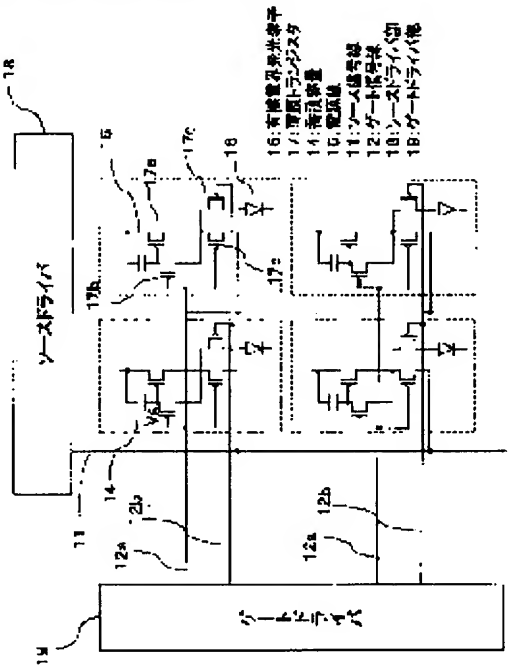
(54) EL DISPLAY DEVICE AND ITS DRIVING METHOD, AND INFORMATION DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To achieve excellent moving picture displaying performance and high contrast display in a display panel using organic EL (electroluminescent) elements.
SOLUTION: In this EL (electroluminescent) display device, a current is programmed from a source driver IC 18 to a pixel so that an EL element 16 emits light with luminance being n times as large as a prescribed luminance. The programmed current is held in a capacitor 14. A TFT (thin film transistor) 17d is controlled so that the EL element 16 is lighted for a period being one n-th as long as one frame. As a result, an average luminance becomes the prescribed luminance. The vale of (n) is made to be 2 to 6.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] with the 1st actuation which is the drive approach of EL indicating equipment of having the source signal line which impresses the image data which a pixel is arranged in the shape of a matrix, and writes in said pixel, and writes the image data which becomes twice [abbreviation N] the brightness of said pixel in said source signal line The drive approach of the 2nd actuation which impresses the current corresponding to the image data written in said pixel to the EL element of a pixel, and EL display with which a predetermined period and 3rd actuation to intercept are carried out for said current, and the value of said N is characterized by or more 1.2 being six or less.
[Claim 2] A predetermined period is the drive approach of EL display according to claim 1 characterized by being time amount shorter than 1-/N of one frame or the 1 field.
[Claim 3] N is the drive approach of EL display according to claim 1 characterized by or more 1.2 being six or less.
[Claim 4] The EL element which is shown in the organic electroluminescence display with which the pixel has been arranged in the shape of a matrix, and was formed in each pixel, The transistor for a drive which supplies the current impressed to said EL element, and the capacitor connected to the gate terminal of said transistor for a drive, The 1st switching element which impresses an electrical potential difference to said capacitor, and the 2nd switching element which turns on and off the current passed to said EL element, The gate driver circuit which chooses said switching element, and the source driver circuit which sets up the electrical potential difference written in said capacitor are provided. Said source driver circuit The electrical potential difference written in said capacitor is set up so that the current passed to said EL element may be N times the predetermined value. Said electrical potential difference It is EL display which is impressed to the pixel of the 1st switching element which said gate driver circuit chose, intercepts said 2nd switching element with the current which flows to the predetermined period of the one frame, and said EL element, and is characterized by the value of said N being six or less [1.2 or more].
[Claim 5] The EL element which is shown in the organic electroluminescence display with which the pixel has been arranged in the shape of a matrix, and was formed in each pixel, The transistor for a drive which supplies the current impressed to said EL element, and the capacitor connected to the gate terminal of said transistor for a drive, The 1st transistor component which impresses an electrical potential difference to said capacitor, and the 2nd transistor component which turns on and off the current passed to said EL element, The gate driver circuit which chooses said transistor component, and the source driver circuit which sets up the electrical potential difference written in said capacitor are provided. Said source driver circuit The electrical potential difference written in said capacitor is set up so that the current passed to said EL element may be N times the predetermined value. Said electrical potential difference It is impressed by the pixel of the 1st tolan JISUTAGU component which said gate driver circuit chose. Said 2nd transistor component It intercepts with the current which flows to the predetermined period of the one frame, and said EL element. Moreover, the ratio of said capacitor capacity C1 and the gate-source capacity C2 of said 1st transistor component C1: EL display characterized by being 2= 20:1 or less more than C2=200:1C1:C.
[Claim 6] The EL element formed in each pixel, and the transistor for a drive which supplies the current impressed to said EL element, The capacitor connected to the gate terminal of said transistor for a drive, and the 1st transistor component which impresses an electrical potential difference to said capacitor, The 2nd transistor component which turns on and off the current passed to said EL element, The Personal Digital Assistant possessing EL display panel which has the gate driver circuit which chooses said transistor component, and the source driver circuit which sets up the electrical potential difference written in said capacitor, an antenna, a voice demodulator circuit, and a key input circuit.
[Claim 7] The information display characterized by EL display according to claim 4 or 5, the video-signal processing circuit, and providing an applied-voltage adjustment device.
[Claim 8] It is the EL display characterized by to be EL display which has the source signal line which impresses the image data which a pixel is arranged in the shape of a matrix, and is written in said pixel, and to change brightness by adjusting display brightness and changing the current impression time amount and the interrupting time to said EL element when said EL display controls the impression and the cutoff of a current which flows to the current and the magnitude impressed to the EL element of each pixel, and said EL element.
[Claim 9] EL display according to claim 8 characterized by providing a voice recovery function.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is related with information displays, such as a cellular phone using EL display and these of this invention as which an image is displayed mainly with spontaneous light, etc.
[0002]
[Description of the Prior Art] The conventional EL indicating equipment has the gate signal line which operates the switching element and component for making the storage capacitance holding the charge for driving the thin film transistor the power-source line which supplies power to an EL element, and for a drive, and the transistor for a drive, and said storage capacitance memorize an electrical potential difference. The storage capacitance of the pixel of arbitration was made to memorize the electrical potential difference which flows to a source signal line, the electrical potential difference of a power-source line was changed to the current by the thin film transistor for a drive, and the EL element was made to emit light by changing a switching element.
[0003] However, in this indicating equipment, dispersion in the property of the thin film transistor component for a drive was displayed on the screen, and there was a problem that the homogeneity of a screen was very bad. The circuit for canceling dispersion in the property of said transistor is shown in drawing 12 .
[0004] The circuit of drawing 12 has EL element 121 in each pixel, and has switching element 123b for turning on and off the power-source line 122 and power-source line which supply power to an EL element, and gate signal line 124a which operates a component. Thin film transistor 123a for a drive is connected with EL element 121, and the current which flows to EL element 121 by thin film transistor 123a for a drive is controlled. In thin film transistor 123for drive a, it has gate signal line 124b for controlling the switching elements 123c and 123d and switching element for writing the current which flows to the storage capacitance 125 and the source signal line 126 for holding driver voltage in storage capacitance 125.
[0005] The method of driving the circuit of drawing 12 stores a charge in storage capacitance 125 so that sink and switching element 123b may be made to 123c, it may make un-flowing and 123d switch-on for the current of the request to the source signal line 126 and a current equivalent to the source signal line 126 may flow to thin film transistor 123a for a drive. After storing a charge, according to the charge stored in storage capacitance by making it flow through un-flowing and 123b in switching elements 123c and 123d, a current is passed from the power-source line 122 to EL element 121.
[0006] This driving method can amend dispersion in the property of the thin film transistor for a drive by writing in a current passing to EL element 121 as it is.
[0007] However, that power consumption becomes large by driving according to a current also about this driving method, and in order to make storage capacitance memorize with a current, the write-in time amount to storage capacitance becomes large, and there are problems, like write-in lack takes place.
[0008]
[Problem(s) to be Solved by the Invention] The drive approach which storage capacitance is made to memorize according to a current has the problem of the write-in time amount to power consumption or storage capacitance as indicated previously.
[0009]
[Means for Solving the Problem] A current program is carried out at a pixel so that EL element 121 may emit light by one N times [predetermined] the brightness of this. An EL element controls switching element 123b so that one frame carries out 1-/N time amount lighting. Therefore, although average luminance and average force current become a predetermined thing, since the current programmed to a pixel is N times, the write-in time amount to storage capacitance 125 is shortened, and write-in lack is canceled.
[0010] Moreover, average luminance [as opposed to average force current in N] rises or less [2 or more] by six, and the power consumption for taking out predetermined brightness can be reduced.
[0011]
[Embodiment of the Invention] In order that each drawing may make a plot easy easily [understanding] in this specification, there are an abbreviation or/and a part which carried out enlarging or contracting. For example, only the part required for explanation is illustrated in the circuit block of drawing 1 . Moreover, the part which attached the same number or the notation has a same or similar gestalt, an ingredient, a function, or actuation.
[0012] It is a low power, and is high display quality, and the organic electroluminescence display panel constituted as a display panel in which thin-shape-izing is still more possible by arranging the plurality of an organic

electroluminescence (EL) component in the shape of a matrix attracts attention.
[0013] The laminating of the organic stratum functionale (EL layer) of at least one layer to which an organic electroluminescence display panel consists of an electron transport layer, a luminous layer, an electron hole transportation layer, etc. on the glass plate (array substrate) with which the transparent electrode as a pixel electrode was formed, and the metal electrode (reflective film) is carried out. The organic stratum functionale (EL layer) emits light by applying the electrical potential difference of minus to a transparent electrode (pixel electrode) anode plate (anode) in the cathode (cathode) of plus and a metal electrode (reflector), namely, impressing a direct current between a transparent electrode and a metal electrode. By using the organic compound which can expect a good luminescence property for the organic stratum functionale, EL display panel can be equal to practical use.
[0014] The circuit diagram of the image display panel by the organic EL device is shown in drawing 1. An image display panel consists of the gate driver 19 sections for displaying the video signal inputted as the source driver 18 section for inputting a video signal. In the source driver 18 section, the video signal for one line changed into gradation data in accordance with Horizontal Synchronizing signal HD is passed to each source signal line 11.
[0015] The gate driver 19 section writes the video signal which flows to the source signal line 11 in a pixel, and makes an organic EL device 16 emit light by operating two kinds of gate signal lines 12 of the gate signal line 12 for holding the video signal inputted as the gate signal line 12 for writing a video signal in a pixel, and continuing turning on an organic EL device 16.
[0016] The detailed configuration of a pixel is shown in drawing 2 . This pixel is constituted by the gate signal line 12, it, organic EL device 16a and capacitor 14a which operate drive transistor (henceforth referred to as TFT) 17a, TFT(s) 17b, 17c, and 17d, and TFT as three switching elements, current supply Rhine 15a, and the source signal supply line 11. Although TFT17 changes also according to the class of component, the gate signal line 12 connected with a component here is un-flowing by Hi, and is flowed through it by Low.
[0017] Then, the structure which this pixel turns on is explained. The magnitude of each pixel of displays, such as a cellular phone and a monitor, is 100 micrometers wide and about 250 micrometers long, and although a current value required for the source signal line 11 for obtaining the brightness of 100 candelas/square meter changes with a foreground color and external quantum efficiency, it is about [about 1micro] A. The source driver 18 side passes 1microA for a current value from a current source 10 to pass 1microA to an organic EL device 16.
[0018] A non-flowing signal is impressed to the signal and the gate signal line 2 through which TFT17 flows on the gate signal line 1 in a selection line, and a continuity signal is conversely impressed to gate signal line 12a in a non-choosing line at non-continuity signal and gate signal line 12b.
[0019] Thereby, in a selection line (in this example, it may be the 1st line), the current of the source signal line 11 flows inside a pixel through TFT17b and TFT17c. Through TFT17a, since it is only connected with EL power-source line 15a, the current of 1microA flows also to TFT17a, and, as for the current path in a pixel, the charge for gate voltage at this time is accumulated in capacitor 14a. If a non-selection period comes, 17d flows, since 17b and 17c are un-flowing, the current which flows to 17a based on the charge accumulated in capacitor 14a in a selection period will be specified, and the current of 1microA will flow to EL element 16a. Thereby, an organic EL device can be made to emit light.
[0020] That is, by activating gate signal line 12a (ON electrical potential difference being impressed), it lets TFT17b and TFT17c pass, and the current value which should be passed to TFT17a at EL element 16 is passed. TFT17b turns on so that between the gate of TFT17a and a drain may be short-circuited, and it is remembered that the gate voltage (or drain electrical potential difference) of TFT17a passes said current value to a capacitor 14.
[0021] In addition, as for a capacitor (capacitor) 14, it is desirable to consider as the capacity of 0.2pF or more. The configuration using the channel capacity of TFT as other configurations is also illustrated. That is, it is the configuration which does not prepare separately with a capacitor 14 but is made into channel width W of TFT17a, and the magnitude more than fixed.
[0022] It is more desirable to constitute a capacitor from a viewpoint for stabilizing the viewpoint and display action which prevent the brightness fall by leak of TFT17c separately in this way. In addition, the magnitude of a capacitor (capacitor) 14 is good to be referred to as 0.2pF or more 2pF or less, and the magnitude of a capacitor (capacitor) 14 is good to be referred to as 0.4pF or more 1.2pF or less especially.
[0023] In addition, for a capacitor 14, it is this better ** to form in the non-display field between the adjoining pixels in general. Generally, when creating full color organic electroluminescence, in order to form an organic electroluminescence layer by the mask vacuum evaporationo with a metal mask, the formation location of EL layer by mask location gap occurs. When a location gap occurs, there is a danger that the organic electroluminescence layer of each color will lap. Therefore, 10micro or more of non-display fields between the pixels which each color adjoins must be left. This part turns into a part which does not contribute to luminescence. Therefore, it becomes an effective means for the improvement in a numerical aperture to form a capacitor 14 in this field.
[0024] Next, it operates so that gate signal line 12a is passed for it to be inactive (an OFF electrical potential difference is impressed), gate signal line 12b may be activated, it may change to the path containing TFT17d by which the path for which a current flows was connected to said 1st TFT17a list at EL element 16, and said EL element 16 and the memorized current may be passed to said EL element 16.
[0025] At drawing 1 , all TFT(s) consist of P channels. Although P channels have somewhat low mobility as compared with TFT of N channel, since pressure-proofing cannot generate degradation easily greatly again, either, it is desirable. However, it does not limit only to this invention constituting EL element 16 configuration from P channels. You may constitute only from an N channel. Moreover, you may constitute using both N channel and P

channels.
[0026] In addition, TFT(s) 17b and 17c are constituted from same polarity, and it constitutes from an N channel, and, as for TFT17a and TFT1d, constituting from P channels is desirable. Generally the effectiveness which uses TFT17a as P channels to the EL element which obtains the luminescence reinforcement made into the purpose is large [TFT] by there being the features, like there are few reliable kink currents, and controlling a current P channels as compared with the N channel TFT.
[0027] EL element 16 configuration of this invention is controlled by two timing. The 1st timing is timing which makes a required current value memorize. When TFT17b and TFT17c turn on to this timing, the predetermined current I1 is written in from the source signal line 11. Thereby, TFT17a will be in the condition that the gate and a drain were connected, and a current I1 will flow through this TFT17a and TFT17c. Therefore, the electrical potential difference of the GETO source of TFT17a turns into the electrical potential difference V1 on which I1 flows.
[0028] The 2nd timing is timing which TFT17a and TFT17c close and TFT17d opens. The electrical potential difference V1 between the source-gates of TFT17a becomes [being held with as, and]. In this case, TFT17a becomes fixed [the current of I1] in order to always operate in a saturation region.
[0029] In addition, the gate of TFT17a and the gate of TFT17c are connected to the same gate signal line 12a. However, the gate of TFT17a and the gate of TFT17c may be connected to a different gate signal line 12 (it enables it to control TFT17b and TFT17c according to an individual). That is, a 1-pixel gate signal line becomes three (the configuration of drawing 1 is two). By controlling the ON/OFF timing of the gate of TFT17a, and the ON/OFF timing of the gate of TFT17c according to an individual, the current value variation of EL element 16 by dispersion in TFT17 can be reduced further.
[0030] If 1st gate signal line 12a and 2nd gate signal line 12b are carried out in common and it is the conductivity type (N channel and P channels) with which the 3rd and 4th TFT(s) differed, simplification of a drive circuit and the numerical aperture of a pixel can be raised.
[0031] If this actuation is seen by the actual wave, it will become like drawing 3 . Corresponding to Horizontal Synchronizing signal HD, gate control signal 32of gate 12a a falls. At this time, the charge according to a video signal is accumulated in a capacitor 14. And the input period of this selection line expires before the following Horizontal Synchronizing signal, and gate control signal 32a starts. In order to make TFT17 connected with an organic EL device 16 corresponding to it ****, gate control signal 33of gate 13a a falls. Thereby, the current according to a capacitor 14 flows and emits light from current supply Rhine 15 to an organic EL device 16. And gating waveform 33a continues maintaining Low until the signal input period of this line next comes, and it maintains the lighting condition of an organic EL device.
[0032] However, the stray capacity 20 by wiring capacity etc. exists in the actual source signal line 11. If stray capacity 20 exists in the source signal line 11, the wave-like provincial accent decided by wiring resistance of the source signal line 11 and the time constant of stray capacity 20 will be observed. When a current value performs a gradation display, this wave provincial accent changes also with current values which flow to a source signal line, it starts, so that a current value is small, and requires time amount for falling. For example, when wiring capacity was 100pF and 500 ohms of wiring resistance, and changing the current value of a current source 10, time amount required for the time amount which needs the current value of the source signal line 11 and the current value of a contact 1001 to change from 0.24microA to 40nA(s) to change from 40nA to 0.24microA for 300 microseconds was 250 microseconds.
[0033] In a low current field, since there is little movement magnitude of the charge per unit time amount, it is because it is difficult to carry out the charge and discharge of the charge which accumulated in stray capacity 20. Time amount required if the current value which flows to the source signal line 11 by this is low, in order to write in a video signal becomes long. For this reason, the minimum time amount of 1 horizontal-scanning period is required of the gradation method of presentation by the conventional current for 300 microseconds. Now, when the number of scanning lines is 220 like a cellular phone, the flicker by making one frame drive by about 10Hz, the amount of charges of a capacitor 14 changing depending on the OFF property of TFT17, and the current which flows to EL element 16 changing occurs.
[0034] Then, in order to solve this problem, a pulse drive is used for the source signal line 11 as shown in drawing 4 n times to which usual impresses 1/of n times [usual] as many currents as this for n hours. The write-in time amount to a capacitor can be shortened by the ability writing a current higher than usual by this driving method. Since a n times as many current as this will flow also to an organic EL device if a n times as many current as this is passed to a source signal line, only the period of 1/n impresses a current to an organic EL device 16, and it is made for average force current not to change by outputting a gate control signal so that it may be set to 53a, and setting flow time amount of TFT17d to 1/n.
[0035] Since the time amount t which current value change of the source signal line 11 takes is t=C-V/I when the current which flows the electrical potential difference of C and the source signal line 11 to V and the source signal line 11 in the magnitude of stray capacity 20 is set to I, that a current value can be enlarged 10 times can do short time amount which current value change takes to about 1/10. Or even if the source capacity 20 increases 10 times, it is shown that it can change to a predetermined current value. Therefore, in order to write in a predetermined current value within a short horizontal scanning period, it is effective to make a current value increase.
[0036] Since the output current will also become 10 times and the brightness of EL will become 10 times, if an input current is increased 10 times, in order to obtain predetermined brightness, predetermined brightness was displayed by setting the "on" period of TFT17d of drawing 1 to 1/10 over the past, and setting a luminescence period to 1/10.

[0037] That is, in order to fully perform the charge and discharge of the parasitic capacitance 20 of the source signal line 11 and to perform a program for a predetermined current value to TFT17a of a pixel, it is necessary to output a comparatively big current from the source driver 18. However, if a big current in this way is passed to the source signal line 11, this current value will be programmed by the pixel, and a big current flows to EL element 16 to a predetermined current. For example, if it programs with a 10 times as many current as this, naturally, a 10 times as many current as this will flow to EL element 16, and EL element 16 will emit light by one 10 times the brightness of this. What is necessary is just to make into 1/10 time amount which flows to EL element 16, in order to make it predetermined luminescence brightness. Thus, by driving, the charge and discharge of the parasitic capacitance of the source signal line 11 can fully be carried out, and predetermined luminescence brightness can be obtained.
[0038] In addition, this is an example, although one 10 times the current value of this is written in TFT17a (the terminal voltage of a capacitor 14 is set up correctly) of a pixel and ON time amount of EL element 16 is made into 1/10. Depending on the case, one 10 times the current value of this is written in TFT17a of a pixel, and it is good as for 1/5 in the ON time amount of EL element 16. Conversely, one 10 times the current value of this may be written in TFT17a of a pixel, and the ON time amount of EL element 16 may be doubled. This invention has the description in making the write-in current to a pixel into values other than a predetermined value, making into an intermittent condition the current which flows to EL element 16, and driving. On these specifications, in order to give explanation easy, one N times the current value of this is written in TFT17 of a pixel, and it explains increasing the ON time amount of EL element 16 1/N time. However, not the thing to limit to this but a current value 1 time the N of this is written in TFT17 of a pixel, and it cannot be overemphasized that twice (it differs in N1 and N2) as many 1-/N as this is sufficient in the ON time amount of EL element 16. In addition, spacing which carries out an intermission is not limited at equal intervals.
[0039] Moreover, in order to give explanation easy, 1-/N is explained setting these 1F to 1-/N on the basis of 1F (1 field or one frame). However, a 1-pixel line is chosen, and there is time amount (usually 1 horizontal-scanning period (1H)) by which a current value is programmed, and an error is also produced depending on a scan condition. Therefore, the above explanation is only the problem of the shape of facilities for giving explanation easy to the last, and is not limited to this.
[0040] Organic (inorganic) EL indicating equipment has a technical problem also in the point that the method of presentation differs from the display which displays an image as a set of a line display with an electron gun like CRT fundamentally. That is, in EL display, the current (electrical potential difference) written in the pixel is held between the periods of 1F (1 field or one frame). Therefore, if a movie display is performed, the technical problem that profile dotage of a display image occurs will occur.
[0041] In this invention, during the period of 1 F/N **** a current to EL element 16, and other periods (1F (N-1) / N) do not pass a current. The case where carried out this drive method and one point of a screen is observed is considered. In this display condition, image data display and a black display (astigmatism LGT) are repeatedly displayed on every 1F. That is, an image data display condition will be in a discontinuous display (intermittent display) condition in time. If animation data display is seen in the state of this intermittent display, profile dotage of an image is lost and a good display condition can be realized. That is, animation display near CRT is realizable. Moreover, although an intermittent display is realized, the Maine clock of a circuit is not different from the former. Therefore, the power consumption of a circuit does not increase.
[0042] The image data (electrical potential difference) to which light modulation is carried out in the case of a liquid crystal display panel is held at a liquid crystal layer. Therefore, if it is going to carry out a black insertion display, it is necessary to rewrite the data currently impressed to a liquid crystal layer. Therefore, it is necessary to make high the clock of the source driver IC 18 of operation, and to impress a black indicative data to the source signal line 11 for image data by turns. Therefore, if black insertion (intermittent display of a black display etc.) is made into implementation ******, it is necessary to raise the Maine clock of a circuit. Moreover, the image memory for carrying out time-axis elongation is also needed.
[0043] With the pixel configuration of EL display panel of this invention shown in drawing 1 etc., image data is held at the capacitor 14. The current corresponding to the terminal voltage of this capacitor 14 is passed to EL element 16. Therefore, image data is not held like a liquid crystal display panel at a light modulation layer.
[0044] This invention controls the current passed to EL element 16 only by making TFT17d of switching etc. turn on and off.
[0045] That is, even if it turns off the current Iw which flows to EL element 16, as for image data, the capacitor 14 is held as it is. Therefore, if TFT17d etc. is made to turn on to the following timing and a current is passed to EL element 16, the flowing current is the same as that of the current value which was flowing before. If black insertion (intermittent display of a black display etc.) is made into implementation ******, it is not necessary to raise the Maine clock of a circuit with this invention in the case. Moreover, the image memory for not carrying out time-axis elongation is also unnecessary. Moreover, time amount after an organic EL device 16 impresses a current until it emits light is a high-speed response short. Therefore, it is suitable for a movie display and the problem of the movie display which is the problem of the display panels (a liquid crystal display panel, EL panel, etc.) of the conventional data-hold mold can be solved from that of carrying out an intermittent display further.
[0046] For example, for gate signal line 12b, an "on" period is 1F (since program time is usually 1H and the pixel line count of EL display is at least 100 or more lines when current program time is set to 0) conventionally. If it supposes that an error is 1% or less also as 1F and is referred to as N= 10, if source capacity is about 20pF, it can

change from the gradation 0 which starts change most as for time amount also to gradation 1 in about 75 microseconds. If this is EL display of 2 mold extent, it shows that frame frequency can drive by 60Hz.
[0047] Furthermore, what is necessary is just to make the source current into 10 or more times, when the source capacity 20 becomes large with a large-sized display. What is necessary is just to make the "on" period of gate signal line 12b (TFT17d) into 1 F/N, when a source current value is generally increased N times. Thereby, it is applicable to the display for television and monitors etc.
[0048] As mentioned above, only the period of 1-/N of the time amount (about 1 F) which originally turns on TFT17d is made to turn on, and if other period (N-1) / N periods are made to turn off, the average luminance of the 1F whole will turn into predetermined brightness. This display condition is approximated with CRT scanning the screen with the electron gun. The range where a different point shows the image is the point which 1-/N (a full screen is set to 1) of the whole screen has turned on (the range turned on in CRT is a 1-pixel line (it is 1 pixel strictly).).
[0049] In this invention, as the image display field 71 of this 1-/N shows drawing 8 , it moves downward from on Screen 21. In this invention, only in during the period of 1 F/N, a current flows to EL element 16, and other periods (1F- (N-1) / N) do not flow a current. Therefore, an image serves as an intermittent display. However, since it will be in the condition that the image was held according to the after-image at human being's eyes, it seems that the full screen is displayed on homogeneity.
[0050] In this display condition, the image data display 71 and the black display (astigmatism LGT) 72 are repeatedly displayed on every 1F. That is, an image data display condition will be in a discontinuous display (intermittent display) condition in time. By the liquid crystal display panel (EL display panels other than this invention), since data were held at the period of 1F, and the pixel, when it was animation display, even if image data changed, the change could not be followed, but it had become animation dotage (profile dotage of an image). However, in this invention, since the image is indicated by intermittent, profile dotage of an image is lost and a good display condition can be realized. That is, animation display near CRT is realizable.
[0051] Moreover, there is also no contrast fall like [at the time of indicating the liquid crystal display panel by intermittent at EL display, since the black display was completely an astigmatism LGT]. Moreover, an intermittent display is realizable only by carrying out on-off operation of the TFT17d, as shown in drawing 1 . This is because memory of the image data is carried out to the capacitor 14. That is, image data is held during the period of 1F at each pixel 16. Control of TFT17d has realized whether the current equivalent to this image data currently held is passed to EL element 16.
[0052] Therefore, it is changeless to the number of TFT17 which constitutes 1 pixel from a case where it does not consider as the case where an intermittent display is realized. That is, the pixel configuration remained as it was, was removed with the effect of the parasitic capacitance 20 of the source signal line 11, and has realized the good current program. Moreover, the movie display near CRT is realized.
[0053] Moreover, since it is late enough as compared with the clock of the source driver circuit 18 of operation, as for the clock of a gate driver circuit of operation, the Maine clock of a circuit does not necessarily become high. Moreover, modification of the value of N is also easy.
[0054] The direction of image display (the image write-in direction) is made down from on a screen by 1 field eye, and is good also as above from under a screen by the following 2nd field eye. Furthermore, once considering as down from on a screen by 1 field eye and considering a full screen as the black display (non-display) 72, by the following 2nd field eye, it is good also as above from under a screen. ON state voltage (Vgl) is impressed to gate signal line 12a (1), and a pixel is chosen so that it may illustrate to drawing 2 . At this time, OFF state voltage (Vgh) is impressed to gate signal line 12b (1). Therefore, Switching 17b and TFT 17c turns on, and TFT17d is an OFF state.
[0055] The program current Iw flows to the source signal line 11. This program current Iw is supplied by TFT17a. (Current Idd=Iw) . When this current Idd flows, the potential of the source signal line 11 serves as a predetermined electrical potential difference, and the current program of the gate terminal voltage Vg of TFT17a is carried out. The current by which the current program was carried out is an Iw current. That is, as for TFT17a, Vg electrical potential difference is set up so that the program current Iw may flow. If it has other ways of speaking, it can be said that the potential of the source signal line 11 was programmed by the pixel. that is, it can be said that the electrical-potential-difference (**) program was carried out as operating state of a pixel.
[0056] OFF state voltage (Vgh) is impressed to gate signal line 12a (1) after 1H (1 horizontal-scanning period), TFT17b and TFT17c turn off, and an electrical potential difference required to pass the program current Iw to capacitor 14a is held. Moreover, ON state voltage (Vgl) is impressed to gate signal line 12b (1), and TFT17d turns on. Therefore, Ie (= Iw) current flows to EL element 16, and the light is switched on with the current (Ie) by which EL element 16 was programmed.
[0057] The above is actuation of the current program method explained above. However, actuation is differed in fact. The current Ie which flows to EL element 16 is because it is smaller than Iw.
[0058] First, actuation of P channels of TFT is explained. Such the big ON state current flows that TFT has P gate terminal voltage Vg in a minus side. In 0 (V), it turns off completely. The ON state current changes with W/L of TFT and mobility, and S value. It is [about] when W/L of TFT is 6/12. -As for a channel current (Idd), 3 (V) is very slight. - The current of 1 - 5microA flows by 4(V) --4.5(V).
[0059] The matter with one [important] more has a capacity problem between the terminals of a component in the potential of each component. Capacity is between the gate-source terminals of TFT17b. This capacity is about

0.01-0.03pF, when W/L of TFT17b is DABURUGETO which is 6/6 micrometer. It runs through the capacity of this capacitor and is called capacity.
[0060] If a pixel is chosen, since gate signal line 12a will change from Vgh to Vgl, it runs and the potential of gate signal line 12a runs with capacity. this -- running -- Vg electrical potential difference is shifted in the direction of +.

[0061] Next, TFT17a passes a current equal to the current Iw which the source driver circuit 18 absorbs. However, in a black display, the value of the current which TFT17a passes is small. They are 30 or less nAs as an example. With such a current, the charge and discharge of the parasitic capacitance of the source signal line 18 cannot fully be carried out within 1H period. Therefore, potential of the source signal line 18 cannot be made into a predetermined electrical potential difference within 1H period. That is, Vg electrical potential difference is also low and cannot be made into an electrical potential difference required for a black display.
[0062] Therefore, TFT17a passes a bigger current than an original black display to EL element 16. Therefore, EL element 16 emits light more brightly than a request value. Therefore, in EL display panel, a black float is generated and a high contrast display cannot be realized.
[0063] However, since gate signal line 12a changes from ON state voltage (vgl) to OFF state voltage (Vgh), again, it runs, and runs with capacity and an electrical potential difference occurs. It shifts to this black display electrical potential difference that needs Vg electrical potential difference with an electrical potential difference by running. Therefore, TFT17a is programmed not to pass a current at all, or is programmed to pass the black current of a request value. That is, it is programmed by EL element 16 so that only a minute current flows. Therefore, EL display panel of this invention does not have a black float, and can realize a high contrast display. A pixel is chosen as the 1 field (one frame), i.e., a degree, and this Vg electrical potential difference is held until it is rewritten.
[0064] By the method which impresses the n times as many pulse illustrated to drawing 4 as this, the current impressed to EL element 16 becomes large, therefore the terminal voltage generated in EL element 16 also becomes high. Therefore, if amplitude value of the gate signal line 12 is not enlarged, either, EL element 16 cannot be driven. If the amplitude value of the gate signal line 12 becomes high, it will run, and will generate and run through capacity and an electrical potential difference will also become large. Therefore, in this invention, a good black display is realizable. This effectiveness becomes about **** or more by n= 2. Therefore, it is desirable that n carries out to two or more in invention.
[0065] Moreover, the current which flows switching element 123b to the source signal line 126 by flowing through un-flowing and 123c and 123d can be written in storage capacitance 125 also about the circuit of drawing 12 . According to the charge stored in storage capacitance 125 by making it flow through un-flowing and 123b in switching elements 123c and 123d, a current is passed from the power-source line 122 to EL element 121.
[0066] Therefore, if the current which flows to a source signal line is increased N times, the current written in storage capacitance will increase N times. Moreover, since the time amount which flows to an EL element by setting flow time amount of one frame of switching element 123b to 1-/N is set to 1-/N of one frame, it is possible to use the same driving method also about the circuit of drawing 12 .
[0067] It ran through this invention and it has realized the good black display, using an electrical potential difference well. If the pixel line of relevance is chosen and ON state voltage is impressed to gate signal line 12a, it will shift in the direction in which the electrical potential difference of a gate signal line runs, and Vg electrical potential difference becomes about a white display more. However, this electrical potential difference through which it ran is charged with the electrical potential difference from the source signal line 18 for a short time. Since it is the direction to which the gate terminal voltage of TFT17a falls especially, TFT17a becomes in the direction which passes a current more, and is charged for a short time. therefore, the time of ON state voltage being impressed to gate signal line 12a -- running -- it does not become a problem at all.
[0068] If the pixel line of relevance is un-chosen in the period of 1H and OFF state voltage is impressed to gate signal line 12a, a Vgh electrical potential difference will be impressed to gate signal line 12a, it will run in it, and an electrical potential difference will occur in it. this -- it runs and the gate terminal voltage of TFT17a reaches a target black display electrical potential difference with an electrical potential difference.
[0069] As mentioned above, this invention runs through the voltage variation of gate signal line 12a, supplies it to TFT17a through capacity, and is controlling the current which flows to EL element 16. Especially this control is effective in realizing a black display.
[0070] The case where the current of the white display to EL element 16 is being passed this time is considered. If a pixel is chosen, it will be programmed by the gate terminal of TFT17a so that the current of a white display flows. This programmed current flows to EL element 16.
[0071] The current impressed to EL element 16 by the method which impresses the n times as many pulse illustrated to drawing 4 as this is large. In order to pass a big current to EL element 16, it is necessary to make low gate terminal voltage Vg of TFT17a. Of course, the potential of the source signal line 11 also becomes low.
[0072] Therefore, by white display, Vg is programmed with low potential. However, it runs, and generates and runs through capacity and the electrical potential difference is the same as that of the case of a black display. On the other hand, since the potential of the source signal line 11 is low as compared with the case of n= 1 in the case of n= 1 or more, white display brightness increases. Therefore, brightness becomes high by n= 2 so that it may illustrate to drawing 6 .
[0073] Change of the brightness when changing n at the time of n time pulse drive use to drawing 6 is shown. The brightness said in this drawing breaks the brightness when changing n by the current value which flows to the both

ends of an organic EL device 16 (that is, average luminance), and expresses the brightness ratio of each pulse drive when a graph usually sets the brightness of a drive to 1.
[0074] As for n, this drawing 6 shows that brightness is usually (n= 1) high at the one or more times or less of six. However, if n becomes six or more, brightness will fall. It turns out that a graph draws a curve beyond not from proportionality with the perfect relation between the current built over an organic EL device as this shows drawing 7, and the brightness which emits light but from a certain current value (that is, the luminous efficiency over a unit current falls). for this reason, if the current which enlarges n and is impressed to an organic EL device becomes large too much, the luminous efficiency of the organic EL device itself worsens, and brightness will become low even when average force current is the same.
[0075] From this, if n uses or more 1 drive [or less 6 pulse], the brightness to average force current will go up the method of driving an organic EL device. Moreover, if it displays that an image illustrates to drawing 4 by n times as many pulse drive as this, a black display will be good or more by n= 2, and display contrast will improve. Moreover, the animation display engine performance also improves by leaps and bounds.
[0076] Moreover, the current which flows to EL element 16 is turned on and off by turning TFT17d on and off. Therefore, the image display field 71 will be in the condition of having been scanned in the vertical direction of a screen so that it might illustrate by drawing 8 . At this time, the part of a black display is the field which turned off EL element 16.
[0077] if the percentage that the black display 16 occupies to all the fields of a screen is 20% or more, the animation display engine performance will be markedly alike, and will improve. An improvement effect is high by considering especially as the time of 50%. In 20%, the black viewing area 16 is N= 1.2. Therefore, when aiming at an improvement of the animation display engine performance, N should just carry out to six or less [1.2 or more]. Furthermore, as for N, it is desirable to carry out to six or less [1.5 or more].
[0078] In addition, if N= 5 is exceeded, a flicker may be conspicuous from a viewpoint of the frequency of a frame rate. Therefore, N should just carry out to five or less [1.2 or more] preferably. Furthermore, as for N, it is desirable to carry out to five or less [1.5 or more].
[0079] Moreover, as for the ratio of the capacity C1 (14a) for maintenance, and the gate-source capacity (C2) of TFT11b, it is desirable to make it become the range of 2= 200:1 or more C1:C and 2= 20:1 or less C1:C. By making it this range, the current which flows to TFT11a at the time of a black display becomes the optimal.
[0080] Drawing 9 attaches a demodulator, an antenna 91, and a carbon button 94 in the indicating equipment 92 which used at least one gestalt in the gestalt of this invention, and is taken as a case 93 being at a Personal Digital Assistant.
[0081] When using a display panel 92 for information displays, such as a cellular phone, it is desirable to mount a driver IC in one side of a display panel (the gestalt which mounts a driver IC in one side still in this way is called a three-side free configuration (structure).). Conventionally, the gate driver IC was mounted X side of a viewing area, and the source driver IC was mounted in Y sides. It is because it is easy to design so that the center line of a screen may take the lead in an indicating equipment, and mounting of a driver IC also becomes easy. In addition, a gate driver circuit may be produced with a configuration free three sides with elevated-temperature polish recon or a low-temperature polish recon technique (that is, at least one side is directly formed in a substrate with a polish recon technique among the gate driver of drawing 1 , and a source driver).
[0082] Generally, priority is given to low-power-ization over the number of foreground colors in information displays, such as a cellular phone. Power consumption increases from the reasons of the clock frequency of the circuit to which the number of foreground colors is made to increase becoming high, or change of an electrical-potential-difference (current) wave impressed to EL element 16 increasing. Therefore, the number of foreground colors can seldom be made [many]. To this technical problem, this invention performs error diffusion process or dithering for image data, and displays an image.
[0083] The background of a case is equipped with the CCD camera although not illustrated in the cellular phone of this invention explained by drawing 9 . A photograph is taken with a CCD camera and an image can be displayed immediately in the display screen of a display panel. The data photoed with the CCD camera can be displayed on the display screen 92. The image data of a CCD camera can change 24 bits (16,700,000 colors), 18 bits (260,000 colors), 16 bits (65,000 color), 12 bits (4096 colors), and 8 bits (256 colors) by key input 94.
[0084] When an indicative data is 12 bits or more, it displays by performing error diffusion process. That is, when the image data from a CCD camera is more than the capacity of an internal memory, error diffusion process etc. is carried out, and an image processing is performed so that it may become below the capacity of an internal memory about the number of foreground colors.
[0085] Moreover, if the relation of N1>N2 is realized when setting a current to 1 time as many N as this and setting impression time amount to 1/N2, as shown in drawing 11 , the average force current which flows to an EL element will increase, and average luminance will rise. For example, if [2= 2Ns of N] 1, since the time amount which emits light by the same brightness will double, the average luminance to which an EL element emits light doubles. Therefore, it is possible to change the average luminance of an EL element by changing the amount of currents to impress, and the relation of impression time amount. Using as a lighting device is also possible by carrying out whole surface luminescence of the display panel 92 in a portable information device as shown in drawing 9 using this.
[0086] This lighting device can be changed to the display screen as a portable information device, and the display screen as a lighting device by key input 94.
[0087] However, when it is going to use as a lighting device, the brightness of the display screen of a portable

information device is inadequate for illuminating the 1-meter or more front. When the portable information device is being displayed using the drive approach of this invention, the average current which impresses a current higher than a predetermined current and is impressed to an EL element by establishing interrupting time is controlled. Then, if the time amount which makes a current intercept by key input 94 is changed, the average current impressed to EL will increase and the brightness of a display panel 92 will increase. The use as a lighting device from which brightness can be changed to possible arbitration is possible also for this illuminating a 1-meter or more distant place.

[0088] Drawing 10 attaches the video-signal input 106 and the video-signal processing circuit 104 in the display 101 which used at least one gestalt in the gestalt of this invention, and is taken as a case 107 being at television.

[0089] The protection film (a guard plate may be used) has covered the front face of a screen on television of drawing 10 . It is one purpose to prevent for a body to hit the front face of a display panel 92, and to damage this on it. It has controlled that an outer situation (outdoor daylight) is reflected to a display panel 92 by forming the AIR coat in the front face of a protection film, and carrying out embossing of the front face.

[0090] By sprinkling a bead etc. between a protection film and a display panel 92, it is constituted so that fixed space may be arranged. Moreover, detailed heights are formed in the rear face of a protection film, and space is made to hold between a display panel 92 and a protection film by these heights. Thus, the impact from a protection film controls what is transmitted to a display panel 92 by holding space.

[0091] Moreover, it is also effective to arrange or pour in optical coupling agents, such as solid-state resin, such as a liquid or gel acrylic resin, such as alcohol and ethylene glycol, or epoxy, between a protection film and a display panel 92. While being able to prevent interface reflection, it is because said optical coupling agent functions as shock absorbing material.

[0092] If a protection film is carried out, a polycarbonate film (plate), a polypropylene film (plate), an acrylic film (plate), polyester film (plate), a PVA film (plate), etc. are illustrated. In addition, it cannot be overemphasized that engineering-plastics films (ABS etc.) can be used. Moreover, tempered glass etc. may consist of an inorganic material. Instead of arranging a protection film, coating the front face of a display panel 92 with the thickness of 0.5mm or more 2.0mm or less with an epoxy resin, phenol resin, and acrylic resin also has the same effectiveness. Moreover, it is also effective in these resin front faces to carry out embossing etc.

[0093] Moreover, it is also effective to carry out the fluorine coat of the front face of a protection film or a coating ingredient. It is because it can fail to wipe with a detergent etc. easily the dirt attached to the front face. Moreover, a protection film may be formed thickly and may be used also [front light].

[0094] A screen may not be limited to 4:3 and a wide display display is sufficient as it. As for resolution, it is desirable to make it 1280x768 or more dots. By carrying out a wide mold, the titles and programs of an oblong display, such as a DVD movie and television broadcasting, can be enjoyed by the full screen. As for the brightness of a display panel, it is desirable to make it 300 cd/m2 (a candela / square meter). As for the brightness of a display panel, it is desirable to make it 500 cd/m2 (a candela / square meter) still more preferably. Moreover, the changeover switch is installed so that it can display with the brightness (200 cd/m2) suitable for the Internet or the usual personal computer activity.

[0095] Therefore, a user can make it the brightness of a screen the optimal by the contents of a display, or operation. Making into 500 cd/m2 only the window which furthermore shows the animation, other parts are also preparing a setup made into 200 cd/m2. The TV program is displayed on the corner of a display and it corresponds also to the usage of checking e-mail, flexibly. A loudspeaker becomes the configuration of a tower configuration, and it is designed so that a sound may spread not only to front but to the whole space.

[0096] The technical thought explained in the example of this invention is applicable to a video camera, a projector, stereoscopic television, projection TV, etc. Moreover, it is applicable also to a viewfinder, the monitor of a cellular phone, PHS, a Personal Digital Assistant and its monitor, a digital camera, and its monitor.

[0097] Moreover, it is applicable also to an electrophotography system, a head mount display, an accepting-reality monitor display, a note personal computer, a video camera, and an electronic "still" camera. Moreover, it is applicable also to the monitor of a cash automatic drawer machine, a public telephone, a TV phone, a personal computer, a wrist watch, and its display.

[0098] Furthermore, it cannot be overemphasized to a display monitor, a pocket game device and its monitor, a back light for display panels, or a for home use or business-use lighting system of a homeuse-electronics device etc. that application or application expansion can be carried out. As for a lighting system, it is desirable to constitute so that it can carry out adjustable [of the color temperature]. This forms the pixel of RGB the shape of a stripe, and in the shape of a dot matrix, and can change a color temperature by adjusting the current passed to these. Moreover, it is applicable to displays, such as an advertisement or a poster, the ringer of RGB, an alarm-display LGT, etc.

[0099] Moreover, the organic EL panel is effective also as the light source of a scanner. Light is irradiated by making the dot matrix of RGB into the light source at an object, and an image is read. Of course, it cannot be overemphasized that monochrome is sufficient. Moreover, not the thing to limit to an active matrix but a simple matrix is sufficient. If it enables it to adjust a color temperature, image reading precision will also improve.

[0100] Moreover, the organic electroluminescence display is effective also in the back light of a liquid crystal display. The pixel of RGB of EL indicating equipment (back light) is formed the shape of a stripe, and in the shape of a dot matrix, and a color temperature can be changed by adjusting the current passed to these, and adjustment of brightness is also easy. Moreover, since it is the surface light source, it is bright in the center section of the screen, and the Gaussian distribution which makes a periphery dark can be constituted easily. Moreover, it is effective also

as a back light of the liquid crystal display panel of a field sequential method which scans R, G, and B light by turns. Moreover, even if it blinks a back light, it can use also as a back light of the liquid crystal display panel for animation display by carrying out black insertion.

[0101]

[Effect of the Invention] The display panel of this invention, a display, etc. can realize the homogeneity display within high definition, the good animation display engine performance, and a screen side.

[0102] In addition, if this invention is used, since the information display of a low power etc. can be constituted, power is not consumed. Moreover, since-izing can be carried out [small lightweight], a resource is not consumed. Moreover, even if it is a high definition display panel, it can fully respond. Therefore, it will be kind to earth environment and the space environment.

[Translation done.]